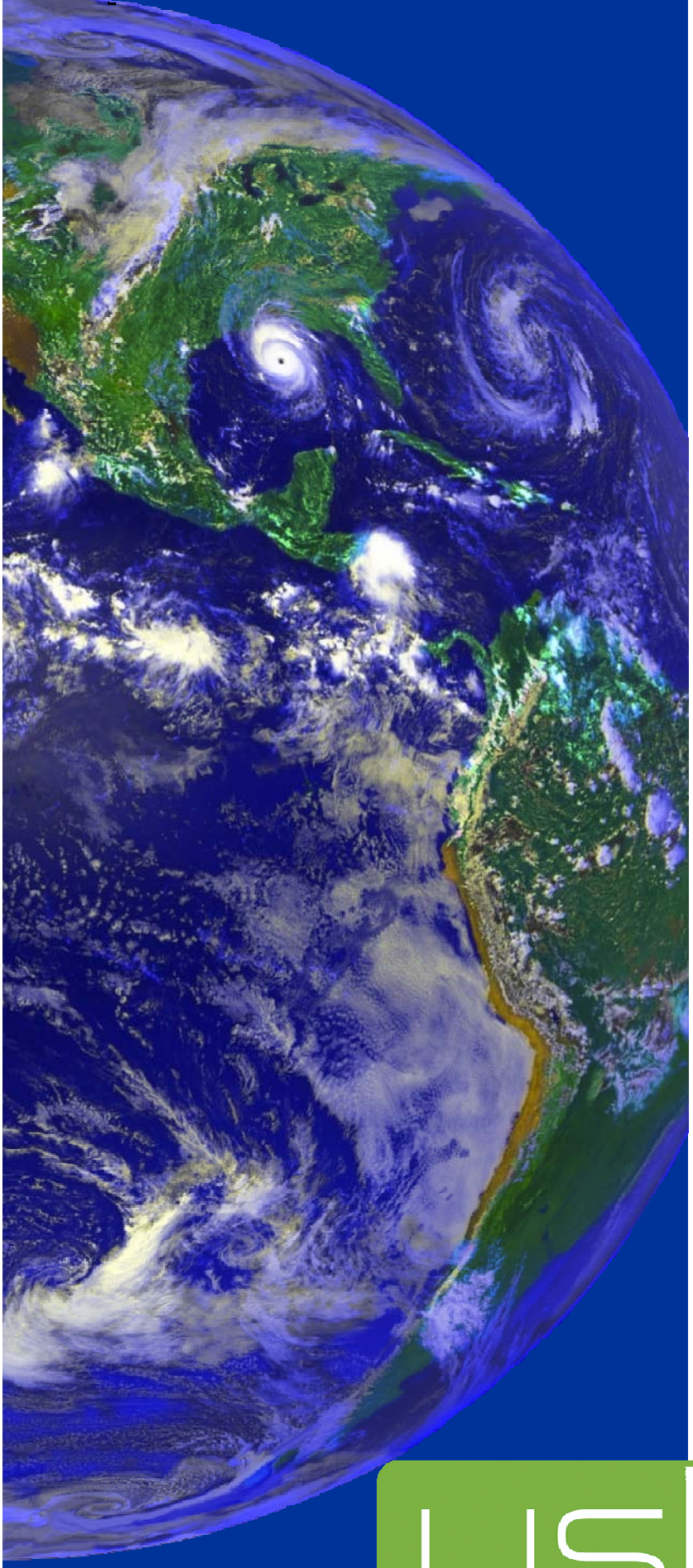


Progress Report of the U.S. Group on Earth Observations

GEO Plenary
28-29 November 2007

Executive Summary

The United States Group on Earth Observations is pleased to present this progress report highlighting early GEO achievements. In addition to addressing new U.S. efforts such as the development of a U.S. Earth Observation Policy and a process for the assessment of Earth observations in the U.S., the report also builds on the GEO Progress Report emerging themes to recommend specific GEO program developments in the areas of drought, air quality, land characterization, disasters, and information dissemination.

USGEO

UNITED STATES GROUP ON EARTH OBSERVATIONS

TABLE OF CONTENTS

1. INTRODUCTION

Establishment of USGEO

Following the first Earth Observation Summit, in July 2003, the United States government formed an interagency group under the auspices of the President's National Science and Technology Council to develop the U.S. component of the Global Earth Observation System of Systems (GEOSS) – an Integrated Earth Observation System (IEOS). The goals of IEOS are consistent with GEOSS in that it is intended to achieve ***coordinated and sustained*** observations of the Earth system in order to improve monitoring of the changing state of the planet, increase understanding of complex Earth processes, and enhance the prediction of the impacts of environmental change.

USGEO Vision Statement

Enable a healthy public, economy, and planet through an integrated comprehensive and sustained Earth observation system.

The United States Group on Earth Observations (USGEO) is a results-oriented organization that comprises representatives from sixteen U.S. federal agencies and the Executive Office of the President and is co-chaired by representatives from the White House Office of Science and Technology Policy (OSTP), the National Oceanic and Atmospheric Administration (NOAA), and the National Aeronautics and Space Administration (NASA).

USGEO Membership

USGEO Co-chairs:

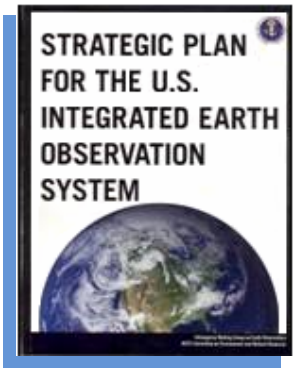
Dr. Gene Whitney (OSTP)

Dr. Teresa Fryberger (NASA)

Ms. Helen Wood (NOAA)

U.S. Government Agencies and White House Offices:

2. USGEO EARLY ACHIEVEMENTS



To provide a framework for the integration of U.S. Earth observations, USGEO developed the *Strategic Plan for the U.S. Integrated Earth Observation System*, released in 2005. This Strategic Plan sets forth goals and requirements for U.S. observing systems and contributions to GEOSS.

The Strategic Plan is organized around nine societal benefit areas that collectively cut across all mission areas of the USGEO member agencies. These nine societal benefit areas are closely aligned to the societal benefit areas developed by GEO and link U.S. efforts to international activities in support of GEOSS. USGEO has already made progress toward realizing the goals set forth in the national IEOS Strategic Plan. Significant accomplishments reported in the USGEO Progress Report for 2006 include the development of plans for air quality, integrated drought monitoring, and land characterization.

USGEO recognizes the importance of transitioning proven Earth observation systems and programs from research to operational status. The research and operational member agencies of USGEO, together with universities, private sector organizations, and international partners have collaborated to enhance existing

Earth observation models and systems and to develop new ones. Such collaboration is key to achieving improved quality and availability of environmental data to benefit the world's economies and populations.

Fostering partnerships with external stakeholders to advance the work of GEOSS and IEOS is a top priority of USGEO. To this end, USGEO organizes a variety of workshops and conferences to develop and reinforce partnerships among government agencies, industry, academia, and non-governmental and international organizations. These activities bring Earth observations to the forefront of discussions on public health, agriculture, climate, and data management and dissemination, to name a few.

U.S. Early Achievement Nominations

1. Arctic Observing Network
2. Establishment of a U.S. National Land Imaging Program
3. GEONETCast: a Global Environmental Information Delivery System
4. Global Space-Based Intercalibration System
5. Large Marine Ecosystem Indicators of Global Change
6. Ocean Surface Topography
7. SERVIR: An Earth Observation, Monitoring, and Visualization System
8. Smithsonian Institution Global Earth Observatory Initiative (SIGEO)
9. Standards-Based, All-Hazards, All-Media Public Warning
10. State of the Climate – A GEO Achievement Using Earth Observations to Monitor the Global Climate
11. The North American Drought Monitor – A GEO Achievement and the Beginnings of a Global Drought Early Warning System
12. USGEO Program to Improve Air Quality Forecasts and Decision Support for Respiratory Health

International Contributions

USGEO plans and coordinates U.S. government engagement in and support for the work of GEO. USGEO participation particularly strives to promote widespread adoption of full and open data sharing policies and practices, and to address capacity building needs as they relate to Earth observations. USGEO experts serve on all GEO committees to support international progress in the implementation of GEOSS.

In 2007, the USGEO began working closely with Brazil, Canada, Argentina, Chile, and other GEO Members in the Americas region to initiate a coordinated effort to facilitate GEOSS implementation in the Western Hemisphere. GEOSS in the Americas provides a conceptual framework to highlight existing collaborative efforts among governments, private industry, non-governmental organizations, and academia throughout the region that support the aims of GEOSS, and to serve as a catalyst for new cooperative initiatives in the region. GEOSS-related activities in the Americas seek to improve the utilization of Earth observations by facilitating partnerships, encouraging the use and exchange of data, and coordinating and leveraging regional assets and resources.

On 10 April 2007, at the Brazilian Embassy in Washington, D.C., the U.S. and Brazil celebrated the successful repositioning of the GOES-10 satellite over South America and the advent of the emerging GEONETCast capability in the Western Hemisphere. Both represent significant first steps in the realization of GEOSS in the Americas. In late June in San Jose, Costa Rica, the 32nd International Symposium on Remote Sensing of the Environment (ISRSE) focused its week-long agenda on GEOSS, providing numerous opportunities for regional dialogue. Costa Rica also hosted a

special press event with their new GEO Principal, Paulo Manso, announcing Costa Rica's new membership in GEO.

In September 2007, Brazil's National Institute of Space Research (INPE) hosted the GEOSS in the Americas Symposium, in Mangaratiba, Brazil. Participants discussed four topics: (1) Biodiversity, Ecosystems and Agriculture; (2) Public Health Observation Systems in the Americas; (3) Earth Observations for Coastal Management; and (4) GEOSS Architecture and Access in the Americas. The Symposium was well attended by a cross-section of experts and stakeholders representing twelve countries and the GEO Secretariat. Discussions were candid with open dialogue on a number of issues, especially related to facilitating capacity building and increasing overall regional participation. Follow-up activities and mechanisms for further coordination currently are in development.

In 2008, cooperation among GEO members and other interested governments in the Americas will continue in order to strengthen regional collaboration and participation by Latin American and Caribbean countries in GEO. As of October 2007, the GEO Americas caucus currently includes Argentina, Brazil, Belize, Canada, Chile, Costa Rica, Honduras, Mexico, Panama, Paraguay, and the United States.

3. USGEO PRIORITY INTERESTS IN GEO

The 2007 GEO Progress Report identifies the following emerging priority areas of high societal and political interest. USGEO supports these themes and proposes some specific projects.

Climate Change and Sustainable Growth

Observation and forecasting of climate change are essential for predicting impacts and developing adaptation measures to enable sustainable growth. IEOS contributes more comprehensive and precise observations which will significantly improve the understanding of vulnerabilities to climate change at global, regional, and local scales.

USGEO supports the concept of the Global Climate Observation System (GCOS) and Global Ocean Observing System (GOOS) as parts of GEOSS. Each year NOAA and the World Meteorological Organization (WMO), along with more than 150 scientists from over 30 countries, transform observations collected from the global array of observing systems into information that enables nations to track the state of the Earth's climate. This information is accessible in the Annual State of the Climate Report which combines historical data with current observations of GCOS Essential Climate Variables to place today's climate in historical context and provides information on trends and changes in climate that affect societies and the environment.

While many observing and analysis systems are unique to countries or regions of the world, through this effort the information from each system is openly shared and this has proven essential to transitioning data to operational use and filling critical gaps in current knowledge about the state of the global climate system. Because the report focuses on the Earth system as a whole, spatial and temporal gaps in data coverage are more easily identified as well as deficiencies in operational systems that provide access to those data. With a focus on integrating observing system data into useful and accessible information, the State of the Climate Report serves as a hallmark achievement of GEOSS efforts to use integrated global Earth observations to monitor and enhance the understanding of climate variability and change. It also serves as an avenue for providing information that decision makers can use to better understand changing environmental factors that affect human health and well-being, and positions decision makers to anticipate and manage future risks associated with climate variation and change.

Climate Change and Sustainable Growth

Examples of U.S. Climate Observation Activities:

- Contributed to the global drifting buoy array
- With Japan and India, extended moored buoy network into the Indian Ocean
- Improved polar region observations
- Improved monitoring from space
  - ICESat
  - MODIS
  - QuickSCAT
  - SORCE
  - GRACE
- ARM Climate Research Facility
- U.S. contributions to the GCOS
- Improved seasonal climate prediction
- State of the Climate report
- NPOESS/GCOM collaboration with Japan

The U.S. proposes the inclusion of all GEO nations in State of the Climate reporting to broaden the collection and analysis of Essential Climate Variables and enhance the understanding of climate variability and change from local to global scales.

Water Security for Society and the Biosphere

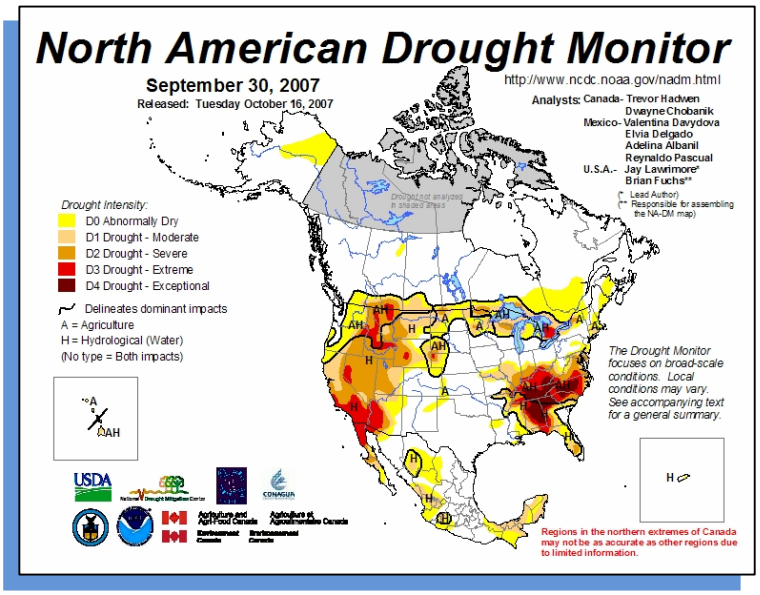
Comprehensive knowledge and effective management of water is paramount to every nation's well-being and economy, as water quality and availability can limit sustainable growth and development. The challenges of managing and ensuring the quality and availability of water are critical issues for the 21st century. Drought is one of the world's most costly and far-reaching natural hazards. With warnings of potential increases in the frequency and intensity of droughts as a consequence of climate change, population increases, and unsustainable water resource practices in many places, the need for a drought early warning system has never been greater. Environmental observations from a myriad of land and space-based observing systems are needed to monitor the state of drought. Improved forecasting methods are needed to provide advanced warning of the onset and evolution of drought, and innovative research activities and new methods for planning and education also are essential elements of a 21st century drought early warning system.

Water Security for Society and the Biosphere

Examples of U.S. Drought Activities:

- North American Drought Monitor
- National Integrated Drought Information System (NIDIS)

Recognizing the need to improve capacities to respond to the growing threat of drought, the U.S., Mexico, and Canada, through the North American Drought Monitor program, have demonstrated how the open exchange of data and information across borders—and the transfer of scientific expertise and data management principles among countries—can enhance the national capacity to deliver drought information on a regular basis. Innovative collaborative methods have also been developed among drought experts at local and regional levels from across the continent. They provide information on drought impacts and local conditions that are unavailable from traditional observing systems. Close coordination among government leaders and scientists in each country—and efforts to identify critical gaps in existing programs and establish methods for addressing deficiencies—have been key to the success of the North American effort. Advances in drought monitoring, planning, and response also are being demonstrated by the U.S. through the establishment of the National Integrated Drought Information System (NIDIS).



North American Drought Monitor map for 30 September 2007.

These two programs are providing a pathway for the development of a global drought early warning system that can synergistically develop products, data, and information. This includes drought assessments related to various sectors and spatial scales providing decision makers essential information for mitigation of drought impacts. By recognizing the potential that national and international collaboration provides and acting now to build upon these GEO achievements, the international community can begin to develop a Global Drought Early Warning System. This enables nations to prepare for and meet the growing threat of drought in the 21st century.

The U.S. proposes the development of a Drought Early Warning System under GEO to aid local, national, and regional decisions regarding human and environmental health and economic welfare during drought.

Changing Landscapes, Ecosystem Health and Biodiversity

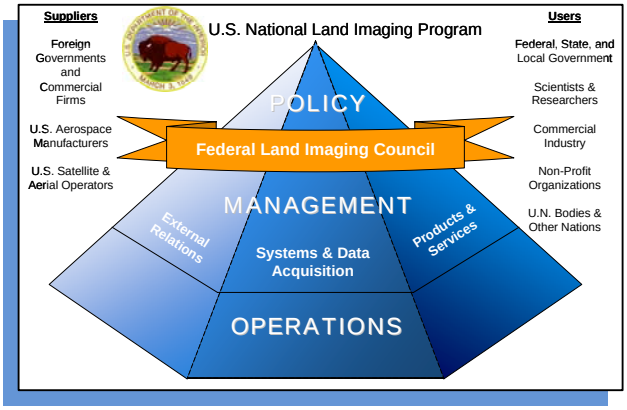
Changing Landscapes, Ecosystem Health and Biodiversity

Examples of U.S. Global Land Characterization Activities:

- Mid-decadal global land survey (MDGLS) data set
- National Satellite Land Remote Sensing Data Archive, 35 year image record
- Enhanced Open Data Sharing Policy
- Land Surface Imaging Constellation
- National Land Imaging Program
- SIGEO network of forest observatories

Land imaging data is used in both operational and scientific activities in all areas of government across all GEO societal benefit areas. Landsat, along with other U.S. and international land imaging systems, provides the information to support societal needs – especially those related to sustainable development, climate variability, land, water, and coastal management, ecology and biodiversity, agronomy and forestry, mining and energy, transportation and urban and rural planning, mapping and surveying, disaster management and relief – and the monitoring of conditions related to human health and well-being. The U.S. is inviting other GEO members to continue providing space-based imaging data to assist policymakers and land management decision makers in responding to these key issues.

As part of a commitment by the U.S. to seek economical approaches to enhance GEO data-sharing and technical collaboration, the U.S. is already working with GEO and Committee on Earth Observation Satellites (CEOS) members on arrangements for exchanging land imaging data. Specifically, the U.S. is working directly with CEOS, as a coordination body within GEO, to promote a Land Surface Imaging Constellation and associated cross calibration methods for land image interoperability. The coordination of future U.S. and international civil land imaging satellite plans and how they can be integrated with scientific, socio-economic, and environmental needs is an important GEO contribution. Additionally, many U.S. agencies, universities, and organizations are providing leadership, data, and methods for the Global Biodiversity Information Facility (GBIF) and the Census of Marine Life (CoML) which build interoperable databases and analytical tools necessary to understand patterns and changes in biodiversity and ecological parameters.



The recommendations for a U.S. National Land Imaging Program could help ensure the future continuity of land imaging resources with the 35-year satellite land data record for U.S. and global economic, environmental, and scientific purposes. The U.S. is producing and distributing a prototype mid-decadal global land survey (MDGLS) data set from the Landsat archive to promote a full and open data sharing policy. This program reflects the long-standing U.S. commitment to maintain the land imaging satellite capabilities on behalf of the international climate research community.

GEO can enhance societal benefit objectives by continuing to bring the world's political, economic, and environmental leadership together with the world's scientists, academics, and organizations to develop system and data sharing agreements and policies for land imaging. A world-wide operational land imaging capability is an essential building block to better address some of the world's most vexing environmental problems.

Disaster Mitigation and Response

Improving our ability to monitor, forecast, mitigate, and respond to natural and human-induced hazards is critical to reducing their impact. USGEO is coordinating the Earth observations required for hazard detection and risk assessment. It is also advancing our capability to predict the occurrence of events so that mitigation and response actions may be better planned and executed.

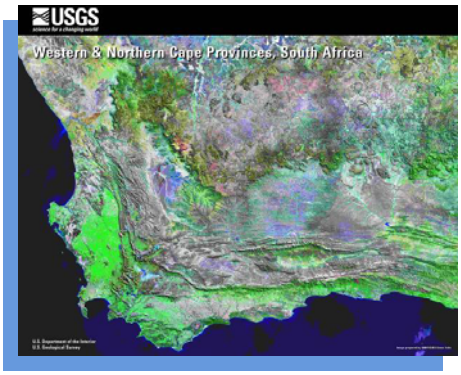
Disaster Mitigation and Response

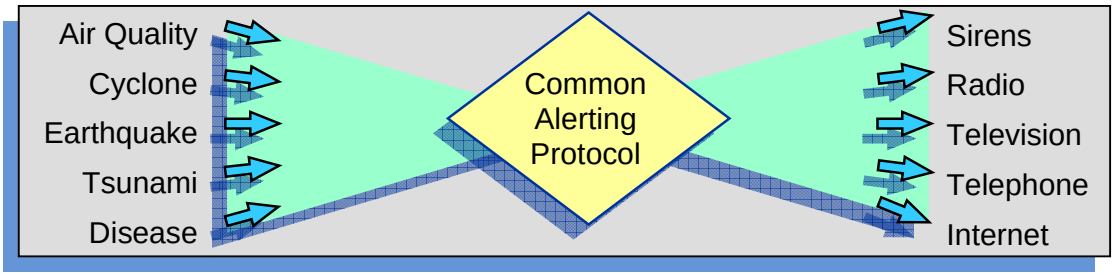
Examples of U.S. Programs and Activities (see Annex of Early Achievements):

- Standards-based, All-Hazards, All-Media Public Warning
- Air Quality Forecasts and Decision Support for Respiratory Health

Standards-Based, All-Hazards, All-Media Public Warning

Early detection of natural hazards is being enhanced through Earth observations, but protection of life and property requires threat information to be readily available for assessment. When public warning is necessary, authorities could then quickly issue alerts on all available media: sirens, highway signs, telephones, cell phones, broadcast television, cable television, radio, Internet, satellite broadcast, etc. As noted in the May 2007 ruling by the U.S. Federal Communications Commission, the Common Alerting Protocol (CAP) standard is required to implement systems that can reach everyone at risk, wherever they are and whenever the event occurs. Designed to make public warnings "all-hazards" as well as "all-media", the International Telecommunication Union (ITU) adopted the CAP standard; called on all member states to implement CAP; and published Guidelines for implementing CAP in developing nations. While the issuing of public warnings is always handled by local authorities, participants in GEO can help assure that CAP alerts are generated for all manner of natural hazards: severe weather, earthquakes, tsunami, volcanoes, fires, floods, droughts, water quality, air quality, disease, pests, invasive species, oil spills, algal blooms, geomagnetic storms, public health threats, etc.





Standard public warning format for all hazards and all media

Air Quality

Another example where Earth observations are making a positive difference is in air quality and health. Air pollution is a serious global public health and environmental quality issue, responsible for more than 800,000 deaths per year and many billions of dollars in economic costs. Improving access to air quality observations can enhance efforts to manage and forecast air pollution, allow individuals to avoid unnecessary exposures, and, thereby, improve and protect public health. To address this issue, the U.S. Environmental Protection Agency, in partnership with other U.S. federal, state, and local agencies, developed AIRNow, a program for the real-time management and mapping of surface air quality observations and forecasts, which are provided to the public through the Internet and mass media. To make real-time data meaningful to the general public, EPA developed the Air Quality Index (AQI), a color-coded scale that ties air quality concentrations to health effects.

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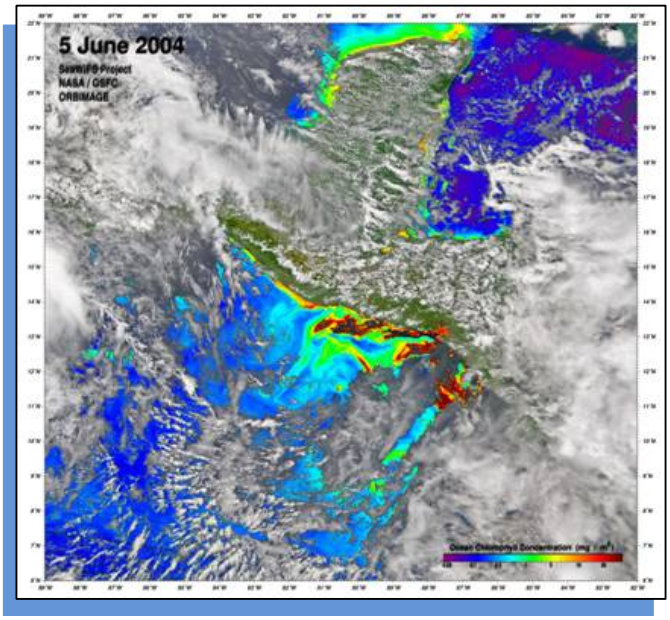
Air Quality Index (AQI) Values	**Levels of Health Concern**	**Colors**
When the AQI is in this range:	...air quality conditions are:	...as symbolized by this color:
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

AIRNow began as a small regional program and grew to a nationwide program featuring hourly data, hundreds of maps, forecasts, and relevant information on air quality. Building on this success, NASA and NOAA have developed systems for integrating surface air quality observations from AIRNow with satellite observations and model forecasts to better inform air quality forecasters, managers, and the public. Agencies in the U.S. are now working to develop versions of such tools that can be implemented in other countries as part of a global interoperable network. A surface observation mapping pilot is planned for Shanghai, China. An integrated surface-satellite observation pilot is being planned for Central America, through the SERVIR project (described on the following page).

During the next year and as part of the GEO work plan, the U.S. proposes that interested GEO countries form a technical working group to provide input to the design of systems and tools to support air quality forecasting and management and become partners in future implementations.

Enhancing Capacity Building

Contributing to the priorities outlined in the GEO Capacity Building Strategy, the USGEO agencies are supporting systems to disseminate environmental information in developing countries through SERVIR and GEONETCast. SERVIR is a unique system that makes available Earth observation data, monitoring tools, and the capability to visualize Earth information in three dimensions. It is based in Panama and serves the eight countries of Mesoamerica. It works by integrating satellite data with ground-level information, and disseminates it to decision-makers, researchers, educators, students, and the public via an Internet web portal (www.servir.net) in Spanish and English. The portal allows for online map-viewing and makes available for download cost-free, intuitive tools that help the user understand the data. With information and tools concerning biodiversity, climate change, disaster management, ecosystems, health, water, and weather, the SERVIR system provides previously inaccessible information that can be applied to directly benefit society. It also encourages the standardization of disparate data sets from multiple sources and the sharing of data across international boundaries.

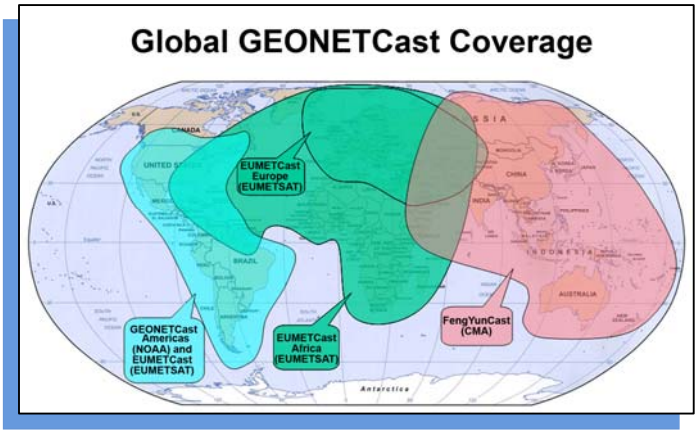


Authorities in Honduras use satellite data made available through SERVIR to monitor potentially harmful algal blooms (shown in red) for the fishing industry.

The functionality of the SERVIR system is expanding to provide support for decisions related to climate prediction, coral reef monitoring, biodiversity conservation, agricultural crop forecasting, and air quality monitoring. Upon request, the system can be replicated and tailored to the needs of other geographic regions. Development of the next regional system will focus on Eastern Africa.

The U.S. also is providing a regional GEONETCast node broadcasting environmental data to users in North, Central and South America and the Caribbean. GEONETCast is a near real-time, global, environmental information delivery system by which all types of observations and application products from GEOSS are transmitted to users through communication satellites, using a multicast, access-controlled, broadband capability. An initial technical capability was demonstrated in 2006, and near-global GEONETCast coverage has been realized in 2007. The communication satellite costs for each sector of the globe are funded by one or more partners in GEONETCast, and the day-to-day management of each sector is their responsibility. Communication satellite providers broadcast using a standard protocol interface, such as the interface used for direct to home television transmission.

Different data streams or products could be available on separate channels. The user decides which data are to be received, managed, and saved locally. Reception equipment is generic, off-the-shelf equipment and is relatively inexpensive.



Expansion of GEONETCast is a major step forward in making GEOSS a reality by providing an alternative means of distributing data and information about the Earth's changing environment to users, particularly those in developing countries, at reasonable cost to both providers and users. Furthermore, it could expand data access by broadcasting the information of complementary delivery systems and thereby extending the reach of those systems.

The U.S. welcomes further partners to support SERVIR, GEONETCast, and other systems that build capacity in developing countries to deliver environmental information.

Improving Interoperability – Cross-Cutting Initiatives, Technologies and Systems

The U.S. IEOS Strategic Plan calls for Integrated Data Management in support of IEOS and the nine societal benefit areas. The 10-year goal of this effort is to provide seamless access to all the data and information from the large number of individual observing systems that make up the IEOS. Assisted by powerful tools for search, discovery, and analysis, a common environment of portals, registries, and middleware will be linked so that data and other resources appear to users as though they are in a single virtual domain. The IEOS data and information products will support decision-making at all levels, with the goal of obtaining societal benefits that provide a high return on the investments in IEOS.

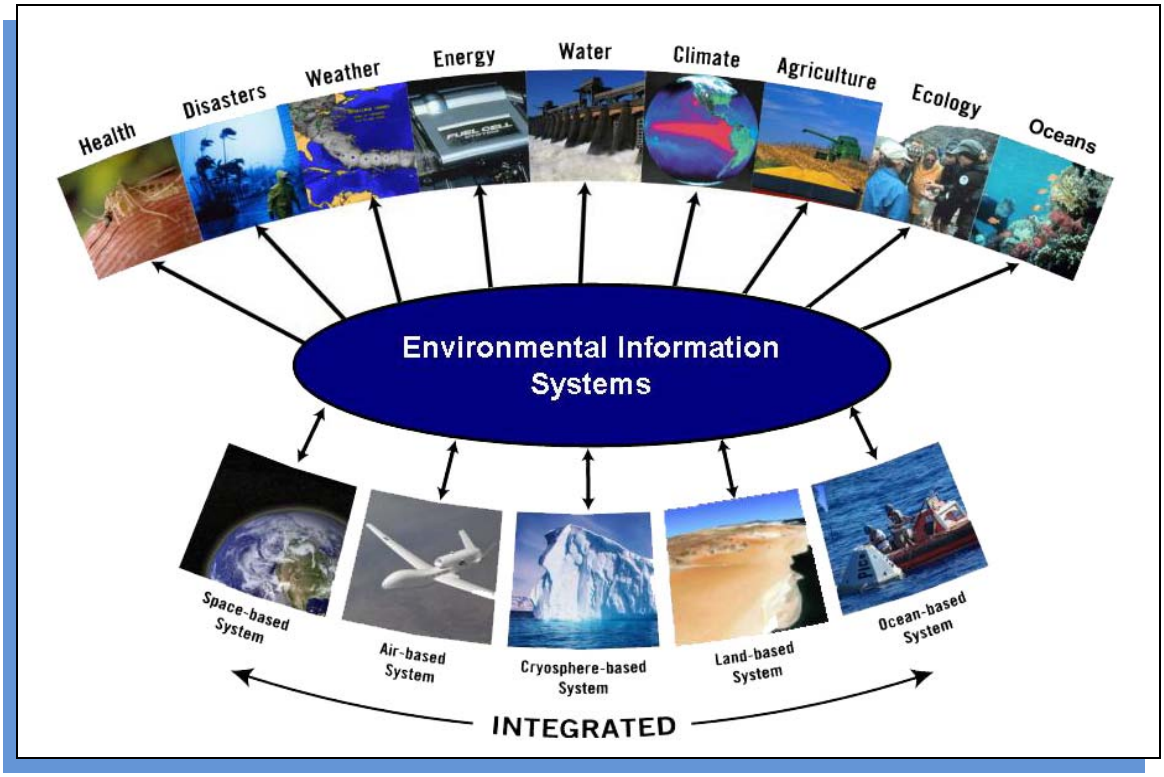
The IEOS plan does not seek to replace current data management systems with a single universal data management system. Instead, the 10-year goal and recommended approach is one which emphasizes: (i) enhancing interoperability among existing data management systems, (ii) exploiting modern approaches to information and knowledge management within large distributed data collections and modern approaches to systems engineering in the development of new data management systems or of extensions to existing data management systems, and (iii) ensuring robust information security and data quality. These efforts will need to be coordinated in such a way that they realize the vision of an information infrastructure for Earth observation systems that provides integrated access to existing and future, real-time and archived data collections, and other information resources.

4. ADDITIONAL ACTIVITIES TO STRENGTHEN IEOS AND U.S. CONTRIBUTIONS TO GEOSS

Capitalizing on the momentum created by the demonstrated accomplishments and early successes, USGEO has embarked on two critical activities that are aimed at strengthening the IEOS and U.S. commitment to GEOSS:

- Development of a U.S. national civil Earth observation policy to ensure that Earth observation capabilities and data are available in a sustained and timely manner to further U.S. scientific, economic, environmental protection and homeland security interests, and to enable effective domestic and international collaboration in Earth observation, and
- Development of a comprehensive U.S. Earth observation investment strategy that will assess national civil Earth observation needs and facilitate the integration of Federal agency observing system investments and environmental information systems to meet those needs.

USGEO continues to focus on facilitating the use of Earth observations in models and decision support systems to improve decision-making and essential services. Emphasis also is placed on cooperation with the international community, U.S. state and local governments, and other public and private organizations on Earth observation and science activities that are of mutual benefit.



UNITED STATES GROUP ON EARTH OBSERVATIONS